

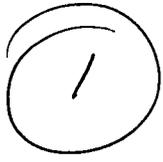
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NUCLEAR ENERGY INSTITUTE

3/5/2015  
80 FR 12041



April 17, 2015

Ms. Cindy K. Bladey  
Chief, Rules, Announcements, and Directives Branch (RADB)  
Office of Administration, Mail Stop: OWFN-12-H08  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

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**Subject:** Industry Comments on NRC Draft Regulatory Issue Summary 2015-XX, "Considerations in Licensing High Burnup Spent Fuel in Dry Storage and Transportation" (Docket ID NRC-2015-0047).

**Project Number: 689**

Dear Ms. Bladey:

On behalf of the nuclear energy industry, the Nuclear Energy Institute (NEI)<sup>1</sup> appreciates the opportunity to provide comments on the draft Regulatory Issue Summary (RIS) 2015-XX that was published in the *Federal Register* on March 5, 2015 (80 FR 12041). The subject addressed in the draft RIS is of significant interest to the industry as we store larger numbers of spent fuel assemblies with assembly average burnups in excess of 45 GWD/MTU.

The industry supports the NRC in having a clear regulatory process established for those licensees and CoC holders approaching license/CoC renewal for storage systems containing high burnup fuel in the next decade. However, the currently proposed RIS does not provide the clarity that will be needed by renewal applicants and the NRC staff that will be reviewing these applications. After reviewing the contents of this RIS, the industry recommends that this document not be issued at this time. NUREG-1927, Revision 1 and NEI 14-03 are already being generated to address license renewal and aging management requirements. These documents provide a clear roadmap to license renewals, thus this RIS is unnecessary at this time. We base this conclusion on the following observations:

<sup>1</sup> NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all utilities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, materials licensees, and other organizations and individuals involved in the nuclear energy industry.

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**SUNSI Review Complete**  
**Template = ADM - 013**  
**E-RIDS= ADM-03**

Add= H. Arkhavanik (HXAZ)

- 1) The RIS inappropriately specifies new requirements beyond those contained in 10 CFR 72, 10 CFR 71 and the guidance provided in ISG-24. For storage, 10 CFR 72.122(h) states in part, "The spent fuel cladding must be protected during storage against degradation that leads to *gross* ruptures or the fuel must be otherwise confined such that degradation of the fuel during storage will not pose operational safety problems with respect to its removal from storage." (emphasis added) For transport, 10 CFR 71.55(d)(2) states that "The geometric form of the package contents would not be *substantially altered* under normal conditions of transport described in 10CFR71.71." (emphasis added) In both storage and transport, there are qualifiers such as "substantially" and "gross" that indicate that the intent of the regulation is to prevent significant damage to the contents (i.e., the fuel assembly), but not to require the integrity of the cladding to be fully maintained. While cladding integrity should be strived for in any storage or transportation package design, some level of minor cladding damage should not be construed as an operational safety problem or a hazard to public health and safety. The RIS should not prescribe of extra-regulatory requirements beyond those stated in the Code of Federal Regulations (i.e., see Comments 3 and 5 in the Attachment).
- 2) The RIS is based on technical information that is not representative of either spent fuel rods or fuel assemblies:
  - a. The primary technical basis for the RIS, Reference 1 (Billone, et. al.), describes testing performed at Argonne National Laboratory based on de-fueled cladding subjected to ring compression testing. This testing neglects to account for the substantial support the fuel pellet would provide to the cladding during any sort of pinching mechanism of the fuel rods. Previous post-irradiation exam (PIE) testing of high-burnup fuel rods show a clear pellet-clad bonding that will provide additional support to the cladding in storage and transportation. The cladding-pellet bond is especially prevalent in high-burnup fuel due to additional pellet swelling from longer exposures in-reactor. This is demonstrated in NUREG/CR-7198, "Mechanical Fatigue Testing of High-Burnup Fuel for Transportation Applications," where fuel rod cladding with fuel pellets "indicate a significant increase in flexural rigidity compared to the results for the defuel[ed] HBU rod specimen."
  - b. The testing described in Reference 1 of the RIS was performed at the NRC-established maximum permissible peak clad temperature (PCT) of 400°C established in ISG-11, Revision 3, "Cladding Considerations for the Transportation and Storage of Spent Fuel." As exhibited in the discussion from the February 25 meeting with the U.S. Department of Energy (DOE) on the High Burnup Research and Development Project (HBRDP), predicted temperatures during the drying process are well below the 400°C PCT limit. This estimated temperature is based on the cask being loaded with high-heat load fuel assemblies that will exceed the currently licensed limit for the cask by almost 5 kW (~20% more than the licensed limit). Spent fuel storage casks currently in service have typically been loaded with much lower heat loads than allowed by the license or CoC, and well below the heat load expected to be loaded for the HBRDP. This confirms the conservatism of the licensing basis thermal analysis versus best-estimate

calculations and shows that the cladding temperatures of fuel assemblies in actual loaded casks will be below the temperatures needed to cause significant reorientation of the hydrides during drying that was exhibited in Reference 1 from the RIS.

- 3) The RIS lacks clarity as to the appropriate place and time that extended operation of storage systems containing high-burnup fuel needs to be addressed. Since the NRC has already stated its regulatory position that there is reasonable assurance of storage of high burnup fuel for the initial licensing period in storage, any RIS should clearly state its applicability to license renewal of a storage cask CoC or site-specific ISFSI.
- 4) This RIS is premature. There is currently not a sufficient technical basis to provide an appropriate risk-informed RIS and ongoing scientific studies should be considered before issuing any regulatory communication in this regard. In the event that there is hydride reorientation and the ductility of the fuel assembly cladding is reduced below that already indicated by irradiated cladding material properties without hydride reorientation, there are insufficient stresses during storage or transport to cause gross deformation of the fuel assembly. Sandia National Labs has been conducting transportation studies to characterize the expected loads experienced during transportation (SAND2012-8323P, SAND2014-18948 [http://energy.sandia.gov/wp/wp-content/gallery/uploads/dlm\\_uploads/BAM-truck-test-SAND\\_Oct-7-2014.pdf](http://energy.sandia.gov/wp/wp-content/gallery/uploads/dlm_uploads/BAM-truck-test-SAND_Oct-7-2014.pdf)). Initial results indicate that the stresses on the fuel assembly during transportation are not sufficient to cause brakeage of fuel rods even with hydride reorientation. Additionally, even if it were postulated for there to be a loss of cladding integrity for a population of the fuel rods, the welded canisters have been certified to not leak during normal, off-normal and accident storage conditions or normal and accident transportation conditions. The pellet-cladding bond and the ceramic structure of the fuel pellet would provide support to the fuel rods that have lost cladding integrity, and prevent a gross redistribution of pellets or cladding throughout the cask interior. While loss of the cladding integrity may cause additional operational complexities during unloading or transport in the future, these would not constitute a threat to public health and safety. The industry has already successfully handled and loaded hundreds of assemblies with cladding breaches, broken rods, loose pellets, etc.
- 5) The guidance provided in this RIS is not consistent with ISG-24, "The Use of a Demonstration Program as a Surveillance Tool for Confirmation of Integrity for Continued Storage of High Burnup Fuel Beyond 20 Years." ISG-24 specifically states that "A demonstration program is one acceptable method for an applicant to provide additional data and evidence in demonstrating compliance with the cited regulations for storage of HBF for periods greater than 20 years." If issued, the RIS should be revised to identify the High Burnup Research and Development project being conducted by DOE/EPRI and the guidance provided in ISG-24 as an acceptable alternative for providing reasonable assurance that spent fuel will not develop "gross ruptures" (10 CFR 72.122(h)) during storage or "be substantially altered" (10 CFR 72.155(d)(2)) during transportation.

Ms. Cindy Bladey  
April 17, 2015  
Page 4

To provide further detail in support of our overall concerns, as well as to inform any future regulatory communications the NRC may propose in this area, we have provided specific comments in the attachment to the letter. If the NRC does intend to issue this RIS despite these concerns, we would appreciate the opportunity to further discuss these issues in a public meeting prior to finalization of the RIS.

Sincerely,



Kristopher W. Cummings

Attachment

c: Ms. Catherine Haney, NMSS, NRC  
Mr. Mark D. Lombard, NMSS/DSFM, NRC  
Mr. Anthony H. Hsia, NMSS/DSFM, NRC  
Dr. Aladar Csontos, NMSS/DSFM/RMB, NRC  
Ms. Huda Akhavannik, NMSS/DSFM/SFLB, NRC  
Dr. John Wise, NMSS/DSFM/RMB, NRC

**Specific Comments on Draft Regulatory Issue Summary 2015-xx, "Considerations in Licensing High Burnup Spent Fuel in Dry Storage and Transportation"**

No.	Location	Comment
1.	Intent, Page 1	<p>The sentence "... for demonstrating compliance with regulations in applications for issuance of dry storage cask CoCs, ISFSI licenses and CoCs for transportation packages involving high burnup spent fuel (HBF)." is in contradiction with other statements in the document, such as "The staff has relied on guidance provided in ISG-11, Revision 3, to review the expected behavior of HBF... ..for up to 20 years in dry storage in the same manner as LBF." The intent should be clarified to be applicable to those applications for license renewal beyond the initial term of 20 years and should not be applicable to the issuance of new dry storage cask CoCs and ISFSI licenses.</p>
2.	Background, p. 2, Paragraph at top of page	<p>Change "The data would confirm the cladding creep behavior and the reorientation of precipitated cladding hydrides resulting from vacuum drying and dry storage" to "The data would confirm the cladding creep behavior and the reorientation of precipitated cladding hydrides resulting from <del>vacuum drying and dry storage</del>. The RIS should not pre-judge the results to be obtained from the High Burnup Research and Development Project (HBRDP).</p> <p>Change "Cladding creep and hydride reorientation may also potentially affect the transportation of HBF depending on if the fuel is being transported from the spent fuel pool or from dry storage." to "Cladding creep and hydride reorientation may also potentially affect the transportation of HBF <del>depending on if the fuel is being transported from the spent fuel pool or from dry storage</del>." See Comment 4 and Comment 11 for justification of these changes.</p>
3.	Background, p.2, Paragraph 3	<p>The paragraph starting "Knowledge of mechanical properties..." through the end of this section does not actually provide background information, but is stipulating additional regulatory requirements for the licensing of high burnup fuel and transportation. In several places the RIS uses the word "require" or "requires" with regard to the analysis needed for licensing of high-burnup fuel. These paragraphs do not clearly delineate which requirements are applicable to storage versus transportation and they are mixed together potentially creating confusion in the future as to what applies to transportation versus storage applications.</p>

No.	Location	Comment
4.	Background, p. 3, Paragraph 1	<p>Change “Although radial hydrides develop in HBF cladding during the vacuum drying process” to “Although radial hydrides <i>may</i> develop in HBF cladding during the <del>vacuum</del> drying process...” There is no indication that it is the vacuum drying process itself that leads to the reorientation of the hydrides, but it is a phenomena associated with higher cladding temperatures that may be achieved during any drying process. Additionally, the development of radial hydrides only occurs if sufficiently high temperatures are achieved to cause the hydrogen to go into solution during the drying process. As indicated in the main comments provided on the RIS, calculations performed for the High Burnup Research and Development Project indicate that these temperatures are not actually achieved during drying. The purpose of the HBRDP is to investigate these phenomena more realistically than in the lab experiments to date.</p>
5.	Background, p. 3, Paragraph 1	<p>The statement “The ability to predict the effects of hydride reorientation and creep on cladding during transportation is required to ensure that the contents meet the conditions of the CoC...” is erroneous. This statement is an attempt to revise the regulatory requirements in 10CFR71 beyond what is required. 10 CFR 71.33(b)(3) requires the contents “Chemical and physical form” to be identified. 10 CFR 71.55(d)(2) requires that “The geometric form of the package contents would not be <i>substantially altered</i>” (emphasis added) under normal conditions of transport described in 10 CFR 71.71. 10 CFR 71.55(e)(1) requires that “the package would be subcritical” “in the most reactive <i>credible</i> configuration consistent with the damaged condition of the package and the chemical and physical form of the contents” (emphasis added) under hypothetical accident conditions. It should be restated that the ability of the applicant to prevent substantial alteration of the contents is the primary goal, not the ability to predict hydride reorientation. It is also not clear why 10 CFR 71.89, “Opening Instructions” is referenced in the last sentence in this paragraph</p>

No.	Location	Comment
6.	p. 4, Storage, 5 <sup>th</sup> paragraph	<p>The sentence starting "However, if data from a demonstration cask is unavailable..." continuing through the end of the paragraph, needs to be modified to read: "However, if data from a demonstration cask is unavailable <i>and no other information is available, the applicant should confirm that the initial conditions of the HBF are as expected by confirming that no more than 1% of the HBF would have failed. The confirmation should include an assessment of the ability of stored high burnup fuel assemblies to continue to perform the intended function(s).</i>"</p> <p>The purpose of the High Burnup Research &amp; Development Project is to provide operational experience from high burnup fuel that has experienced loading, storage and transportation for the purposes of providing reasonable assurance. The information that is expected to be available from the HBRDP before HBF moves beyond 20-years in storage is temperature and gas sampling data. The gas sampling data from the HBRDP will demonstrate that the initial conditions of the HBF, i.e. cladding integrity is being maintained.</p>
7.	p.5, Storage, Last Paragraph	<p>The NRC has already developed guidance that if a canister is constructed, fabricated, welded and inspected in accordance with ISG-15 and ISG-18, then a confinement analysis is not necessary. This paragraph should include a sentence to this effect, so as not to create confusion.</p>
8.	p.5, Storage, Last Sentence & p. 5, Transportation, 5 <sup>th</sup> paragraph, last sentence	<p>Both of these locations contain the stipulation that release fractions needed to be "experimentally justified". The word "experimentally" should be removed so as not to limit the avenues for providing defensible release fractions.</p>
9.	p.5, Last Paragraph	<p>Regardless of the data available on cladding properties, all plants contain fuel loading procedures to ensure that the loaded fuel meets the conditions of the storage cask CoC. Provided that there are no beyond-design basis events that would subject the fuel to an unanalyzed condition, then the fuel would be in the same state as when it was put into the cask system. The inert environment (i.e., helium) in the cask ensures that there is no degradation of the fuel.</p>
10.	p.6, Paragraph 2, last sentence	<p>The additional steps necessary if fuel cladding sections are not above the DBTT are not specified? Without specifying the additional steps and allowing industry to comment on the proposed approach, this guidance does not provide regulatory stability and extends the uncertainty indefinitely into the future.</p>

No.	Location	Comment
11.	p. 6&7 , Backfitting and Issue Finality Discussion	<p>NEI submitted a petition for rulemaking in October 2012, which included a provision for extending the backfit rule to CoC holders. That Petition for Rulemaking provided the following reasons for this extension:</p> <ol style="list-style-type: none"> <li>1) Allows the industry and NRC resources to “be focused on regulatory activities that will yield the most substantial safety benefits.”</li> <li>2) The principles of fundamental fairness that underlie the application of the backfitting rule to licensees require application of the rule to CoC holders.</li> <li>3) Is consistent with the NRC’s Principles of Good Regulation, “...regulation should be perceived to be reliable and not unjustifiably in a state of transition.”</li> </ol>
12.	p. 6&7 , Backfitting and Issue Finality Discussion	<p>In several passages that RIS describes the backfitting rule as “protecting” applicants and licensees. For example, page 6 states: “Therefore, no applicant, licensee or holder of a CoC under Part 71 is <u>protected</u> by any backfitting provision in Part 71.” Also, on page 7 the draft RIS states: “Applicants and potential applicants are not, with certain exceptions, <u>protected</u> by either the Backfit Rule of any issue finality provisions under Part 52. . . .” Although using this type of language to describe the backfitting rule is not uncommon, it mischaracterizes the primary purpose of the rule. The purpose of the backfit rule is to ensure that NRC and licensee resources are devoted to activities that will yield significant safety benefits and are cost-justified, not to “protect” licensees from regulatory initiatives. Consistent and meaningful application of the backfitting process helps to ensure a safety-focused regulatory framework, which is a shared objective of both the NRC and licensees/CoC holders.</p>

No.	Location	Comment
13.	p. 7, Backfitting and Issue Finality Discussion	<p>The RIS states,</p> <p>“The RIS is not directed at <u>activities controlled by the nuclear power plant operating license</u>. Hence, the backfitting and issue finality provisions in the Backfit Rule, 10 CFR 50.109 and Part 52 are inapplicable to the nuclear power licensees who are also holders of either specific or general ISFSI licensees under Part 72.” (emphasis added).</p> <p>Whether the RIS is directed at activities controlled by the operating license is not the appropriate test to determine the applicability of the backfitting rule. Instead, the staff should rely on the definition of backfitting provided in §50.109(a)(1) to determine whether the RIS is, in fact, imposing a backfit. Section 50.109(a)(1) defines backfitting as:</p> <p>“The <u>modification of or addition to systems, structures, components, or design of a facility</u>; or the design approval or manufacturing license for a facility; or the <u>procedures or organization required to design, construct or operate a facility</u>; any of which may result from a new or amended provision in the Commission's regulations or the imposition of a regulatory staff position interpreting the Commission's regulations that is either new or different from a previously applicable staff position after:” (emphasis added).</p> <p>So, the relevant question is whether there are any new or different regulatory staff positions in the RIS that will require: (1) modification of or addition to SSCs or the design of a facility licensed under 10 CFR Part 50, or (2) the procedures or organization required to design, construct, or operate a facility licensed under Part 50. Although in this case application of the definition provided in §50.109 may not change the conclusion that the RIS would not impose a backfit, it is important to consistently apply the proper standard when determining whether regulatory initiatives constitute backfitting.</p>
14.	Enclosure 2	<p>It is not clear why different paths are established for fuel directly shipped from the pool and fuel that has been in dry storage. This should be revised based on whether the fuel temperature is above or below the DBTT at the time of shipment.</p>